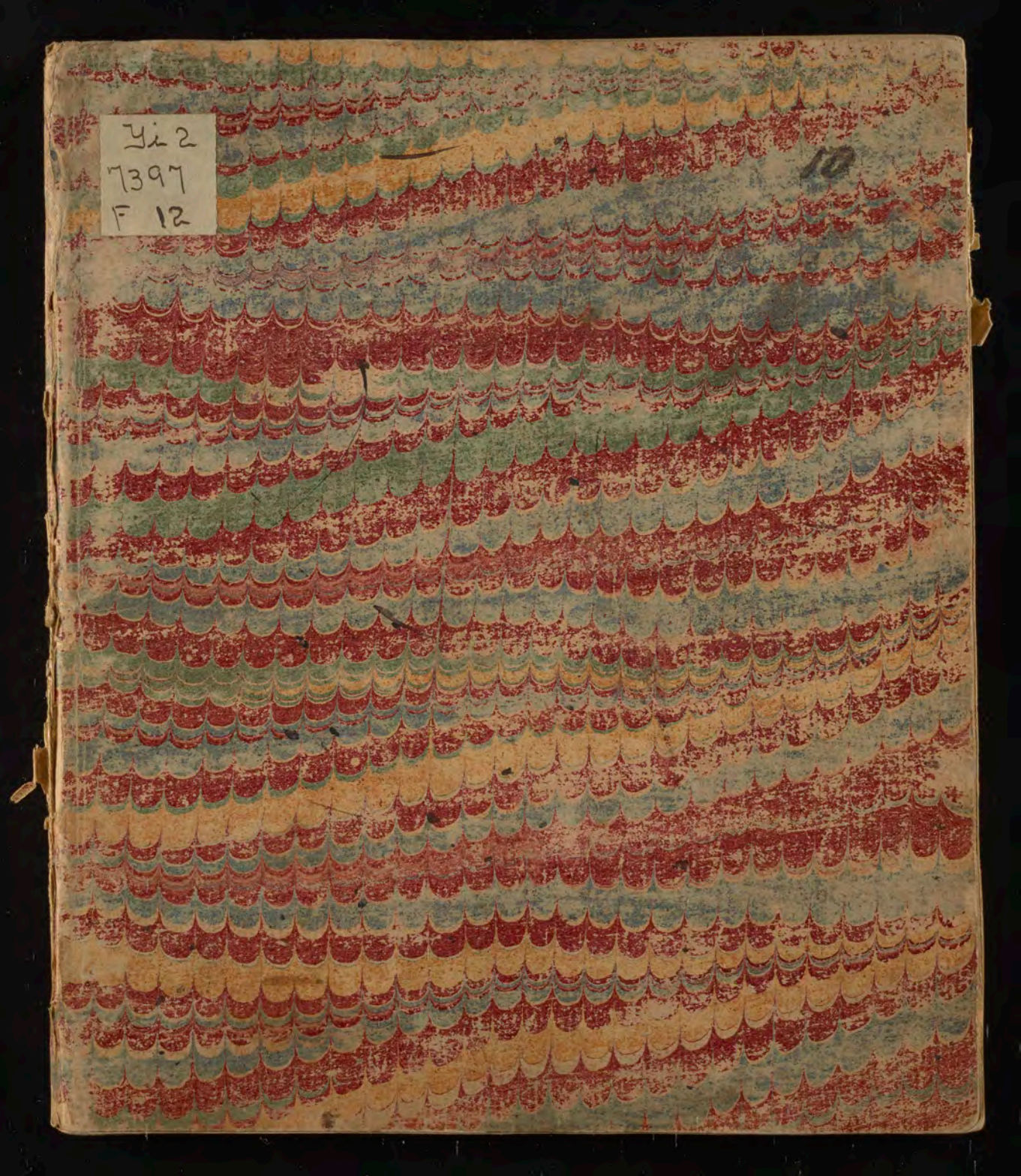


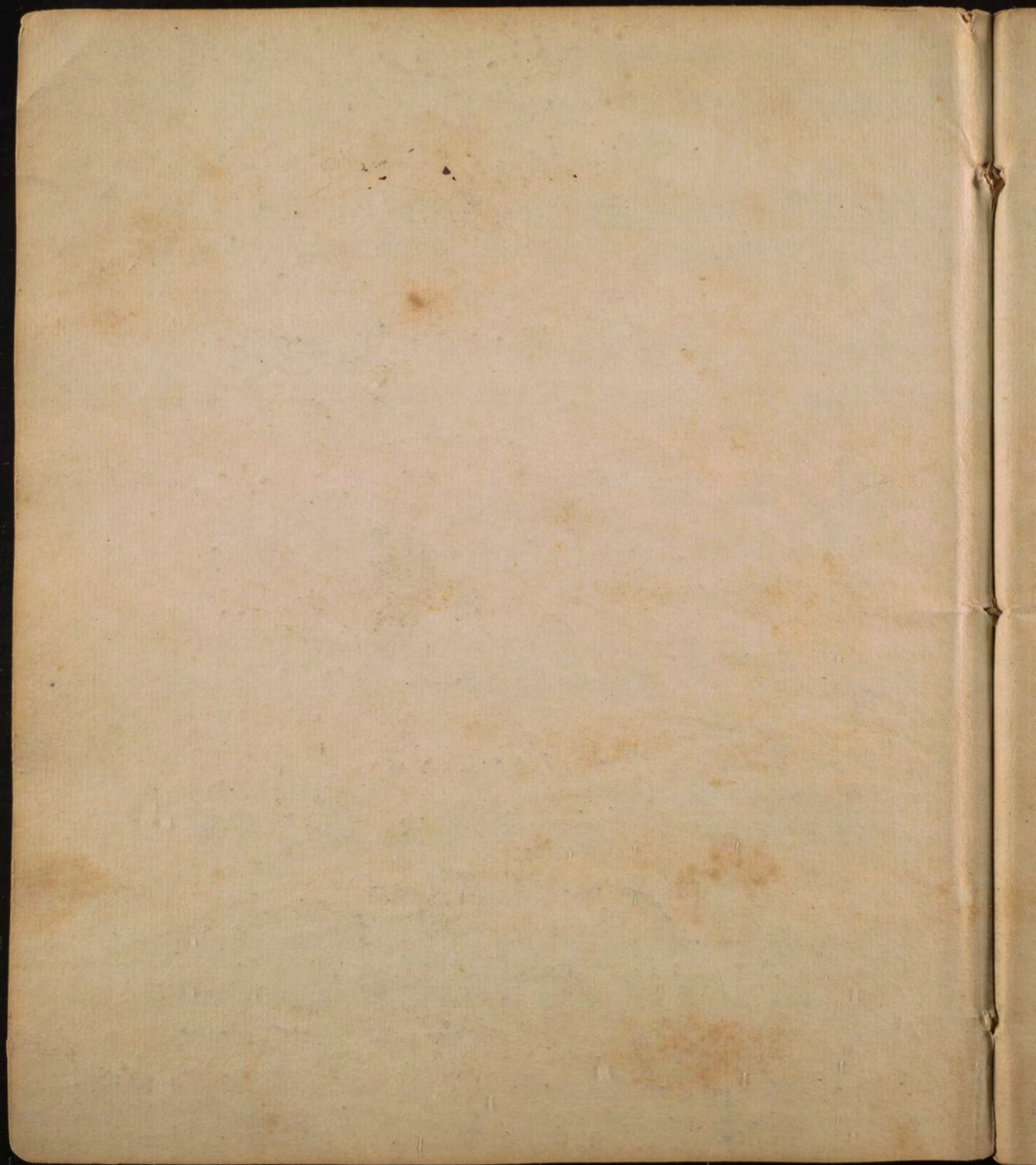
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Hearing - 396

of Hearing. Lect: 15 Dec 30-11

In ~~the~~ treating of this for

1. say a few words on the
sounds, and the manner in
they are propagated.

2. I shall describe the Structure of the
Ear, and the manner in which
sounds are conveyed by it so as to excite
sensations in the mind —

By sound I mean certain tremors
or vibrations communicated ^{from} the
perception of ^a sonorous body thro' ~~the~~ a
^{connecting} ~~medium~~ medium to the ^{Drum} of
the ear thro' which a sensation is
excited in the mind. —

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This ~~conception~~ ^{sound may} be divided into two kinds, viz Sound properly so called, and Noise. By Sound I include musical tones, and whether vocal, or instrumental, and speech. By Noise I mean ~~the~~ those coarse tremors which arise from the concussion of heavy bodies on the earth, or from the explosion of gun powder.

The medium which communicates sound and ^{Noise} ~~is~~ is said to be Air. It is certainly the vehicle of Noise. We observe ^{it to be agitated} its effect ~~is the~~ by the firing of cannon. we feel an artificial breeze created by it, &

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we see windows broken, and the walls
 of houses to be ^{shaken} ~~shook~~ by it. ^{But} ~~was the~~
~~of the earth~~ as well of the air is the
 vehicle of Noise. Of this there many
 proofs occur in the time of war. At
~~late~~ During the battle of Brandywine
 where I attended as a Surgeon, ^{in the year} ~~I should~~
 1777. ~~a field on which I stood about a~~
 quarter of a mile from the two
 armies ^{as} were engaged, ~~to be~~ ^{as} I
 observed the surface of a field on w:
 I stood to become suddenly invisible
 owing to a cloud of dust which rose
 from it, and which stood above
 four feet from the ground. This
 appearance at first surprised
 me, nor did I collect for some

V It passes with different velocities, and to
a different extent thro' each of them.

time that it was occasioned by the
concussion of the earth by the explosion
of cannon and other fire arms. —

During the cannonade of ~~our city~~ ^{my island}
~~was~~ ^{miles} eight ^{below} our city, a British
soldier ^{then a prisoner} at ^{on the Delaware} ~~Reston~~ 70 miles above
our city, ^{one} ~~one~~ morning came into his
quarters & with an air of triumph
he said the city of Philadelphia was taken,
for that the cannonading had suddenly
ceased." This he discovered by ~~putting~~ ^{thrusting}
his knife in the ground, & placing
his ear on the handle of it. A few
days or two it was discovered at
Reston that this soldier was not mis-
-taken. — Not only the ^{air &} earth, but
water is a vehicle of ~~loud~~ ^{noise}.

v Dr Franklin says this noise may
be heard distinctly for one mile.

I have often when a boy heard the
 noise of two stones struck against each
 other ^{under water} with my head parallel to
 them ^{under the water} at the distance of several feet.
 ✓ Divers ^{under water} we are told can hear the
 noise of a ship before she can be
 discovered ^{by the eye on} above the water - at a much
 greater distance ^{said to be}

The air is the vehicle of musical
 and vocal tones whether musical or
 otherwise. — But is not this fluid too
 gross for the fine tones of music, and
 too simple for their immense variety?
 — may not the air like the matter of
 light be a compound body, & consist
 of as many different fluids as the
 matter of light does of colors, and

may not the difference we perceive
in tones be occasioned by impressions
conveyed to the ear by ^{these} different fluids?
— I throw this out only as a conjecture.
I shall still notwithstanding continue
to suppose the air to be the vehicle of
Sound, for if it should contain seven
finer fluids than itself, still it is the
only one that is obvious to our senses
& to experiments. I

That sound is produced by tremors
or vibrations emitted by a sonorous
body, I infer we infer from ^{attending to} observing
a bell when struck by a hammer.
Its tremors may be felt by the hand.
may — they may be seen by the eye.
— The bell in its tremors passes every

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deviate from an ⁴⁰¹ oval to a elliptical form. — I shall now deliver a few general observations on sounds. go to p 413. O

1 The force of sound is in a compound ratio of the size & or mass of the body which strikes & of the number of vibrations emitted by it. The more solid & elastic bodies are, the more readily they emit sound, & vice versa. hence iron & brass — silver, & iron — are more sonorous than Gold or lead. —

2 Bodies are sonorous in proportion as they are more or less tense. a ^{piece} of wire held in the hand without being stretched emits no sound, — the same wire when stretched, emits sonorous vibrations.

3 all solid bodies which strike against other solid bodies, produce sound. ~~the~~

the body of the animal is composed of
many small parts which are called
cells. These cells are the building
blocks of the body. They are
joined together by a substance called
protoplasm. The protoplasm is a
fluid substance which fills the
cells. It is the life-giving
substance of the body. It is
the substance which makes the
body move. It is the substance
which makes the body grow.
It is the substance which makes
the body live. It is the substance
which makes the body die.

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the body struck be inelastic, - the sound emitted will be simple, - In elastic bodies these sounds will be compound.

~~All~~ sounds are divided into acute & grave. Nature has fixed no limits between them. Grave sounds by descending gradually become acute - while acute sounds by ascending, gradually rise into such as are grave. ~~All sonorous bodies vibrate or tremble in emitting~~ The distinction of tones is taken from the number of vibrations of a sonorous body. If there be many vibrations in a second, the sound is called an acute one, and the more the vibrations ^{are} in that time, the more acute the sound, - and on the contrary, the fewer vibrations there are in a

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Second, ⁴⁰³ the more grave the sound.
If these vibrations become so few in a second as to be perceptible to the eye, no sound will be emitted. The celebrated Euler discovered that a ^{sound} vibration to be audible must consist of 30 vibrations in a second; and that ^{when} the vibrations fall below 30 there is no perceptible emission of sound. The same acute philosopher discovered further, that the highest perceptible acute tone consists of 7520 vibrations in a ^{second} minute. From this account of grave & Acute tones you will easily see how impossible it is to draw a line between them. ^a For ~~all~~ tone that consists of 40 vibrations in a second is certainly a grave one,

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but it is acute, compared with a tone
of 30 vibrations in a second, & yet this
is like ^{=wise} belongs to the class of grave tones.

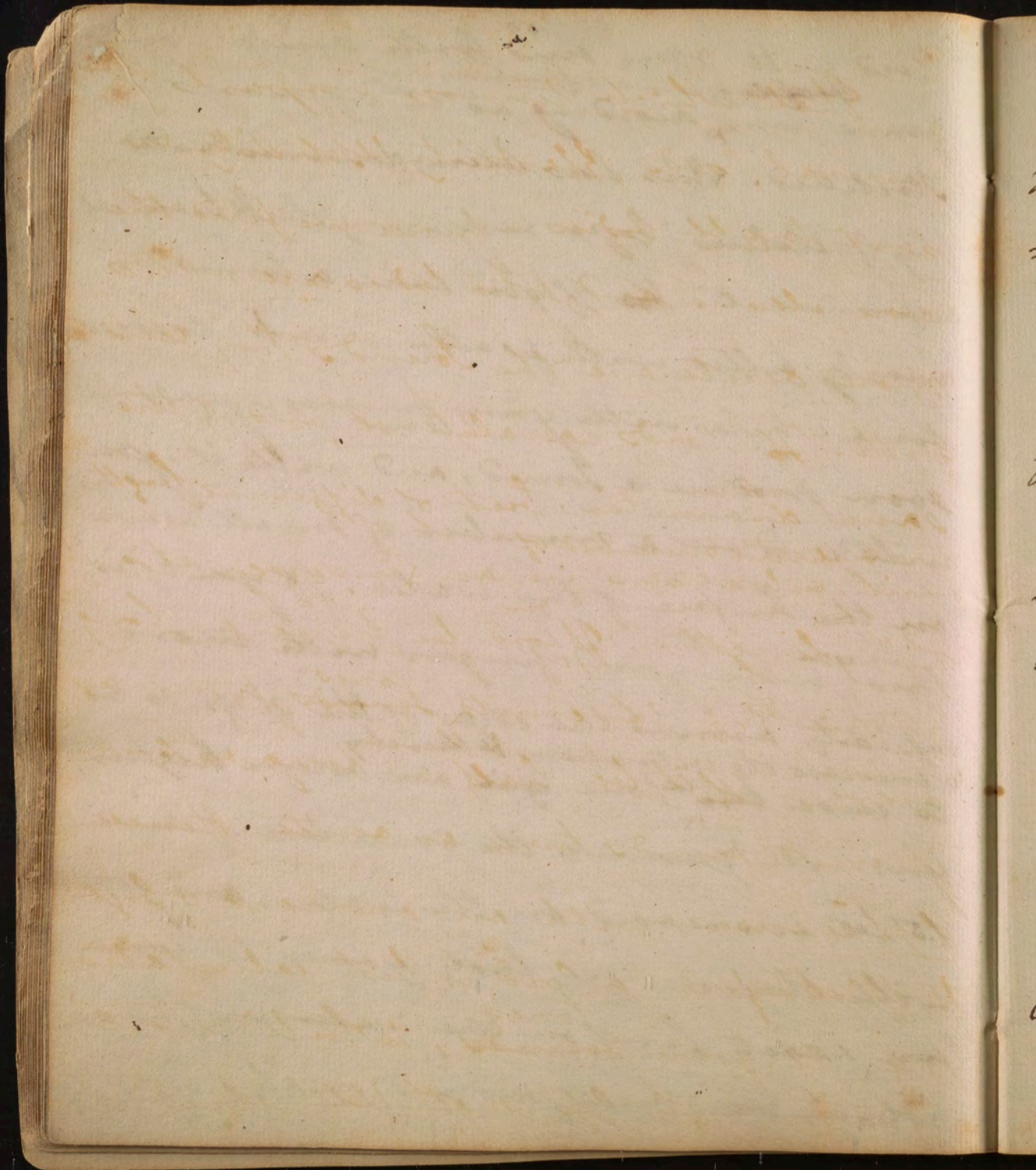
It is necessary here to distinguish
between the antennae & intensity of
sounded tones. Intensity of tone depends on
the force of percussion, and upon the
number of tremulous particles in the
body which is struck, and not upon the
number of its vibrations. It has been
remarked by M^r Sauveur (M^{em}: de l'Acad^{em}: de Paris
1700) that a Cord which emits a definite
or limited number of tones in a second, may be
made to emit sounds 72 ^{times} greater or less
in degree at the same time, without
varying ^{its} vibrations in the least,
or its tones with regard to gravity, or
Antennae. He remarked further, that

v by ~~tones~~ of this description emitted
by ~~the~~ ^a Ram horn.

from tones so grave as scarcely to be perceptible, we often observe ^{pillars & even} walls to be moved. This has often been effected by a Church organ. — ~~The walls of Jericho have been supposed to have been thrown down~~

The greater or less frequency of vibrations ^{or the difference of} ~~on which the difference of tones depends~~ has been found to depend on the following particulars: 1 the length of the cord — 2nd its thickness & 3 its degree of tension. ^{On} the matter of which the unvoiced cord is made whether it be ^{metal} ~~smaller~~ or cat gut. Two cords composed of the same materials, of equal thickness, — and equally stretched, always emit the same number of ^{and} vibrations in a second. They are, in this situation to be in Unison with each other. — The more tense a cord, the more acute its tones, the same

Cord will often send forth notes, or
~~be affected~~ from a difference in its vibrations,
 grave tones, according as it differently
 stretched. This has been demonstrated
 (by Galileus) by a very simple & beautiful
 experiment. ~~the~~ If you take a tumbler
 nearly filled with water, & rub its edges
 for a while with your fingers, you will
 soon produce a sound, and with it, you
 will produce a number of small waves
 on the surface of the water. If you after
 this, ^{you} move your fingers with more
 rapidity around the edges of the glass, so as
 to increase its vibrations & thereby
 to raise ~~the~~ ^{its} tone of it an octave higher,
 you will perceive the number of the waves
 to be increased on the water, and you
 will observe these last waves to form
 an exact line on the water with those
 which were first produced on it.



That which tension imparts to
 musical cords, Elasticity & Solidity im-
 -part to all bodies - hence we find the
 more elastic and solid bodies are, the
 more acute are the sounds they send
 forth. If Cords equally tense, and of the
 same diameter, but of different lengths,
 emit vibrations in an inverse ratio of
 their lengths. If ^{one} cord be twice as long
 as another, it emits ^{tones} ~~sounds~~ twice as
 grave, - if it be half as long as another,
 it emits sounds twice as acute. Hence
less tension, with an increase of length
 & thickness in a cord, is best calculated
 to emit grave ^{tones} ~~sounds~~, while more
 tension with less length & thickness in a

Cord is best calculated to produce ~~more~~ acute tones. It is to be observed here however, that there is no Chord, or pipe so exactly toned, or so struck, as to emit one tone only. A cord when struck ^{with} great force frequently emits tones of different degrees of acuteness or gravity, especially in its first Vibrations.

From the Variety in the proportion of the Number of Vibrations, Musicians have introduced certain ratios of the Variety in their tones, which they have distinguished by the following names.

1 They call ^{that} Consonance, when Musical Cords are in Union with each other, & send forth the same number of Vibrations in exactly the same time.

2 They call that an Octave when

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a Cord A sends forth ~~the~~ ^{one} foot in length, sends forth half the number of vibrations of a cord B.

of two feet in length - but equal in ^{every other or every} all other circumstances. ~~These~~ ^{second} vibrations

of these two cords are in unison with each other. This tone is called a superior Octave ~~also~~ to distinguish it

from an inferior Octave which is when

^{vibrations of the} the cord A are somewhat less. Be-

-tween two Octaves, good ears can dis-

-tinguish 43 different tones.

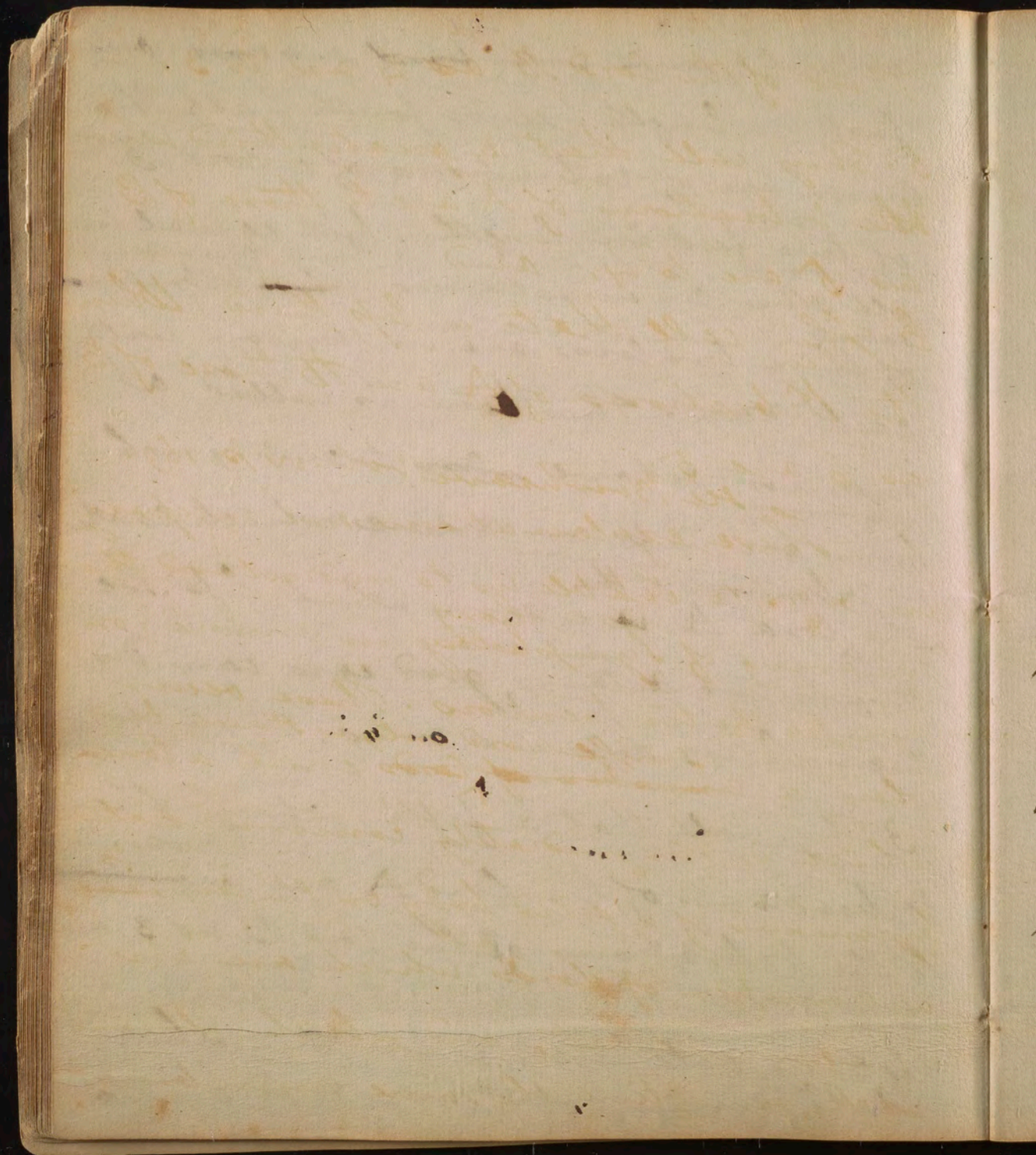
3 They call that a fifth, when the

vibrations of the cord A are in ^{proportion} ~~number~~

to the vibrations of the cord B as 3, are to 2.

4 They call that a fourth when

the vibrations of the cord A are to



those of the Cord B. as 4 are to 3.

5. They call that a greater third when the vibrations of A are to those of B:

as 5 are to 4, and

6 They call that a less third, when the vibrations of A are to those of B:

as 6 are to 5. See Bourneville vol: iv p: 169.

These explanations are necessary in order to enable us to understand the meaning of ^{hony}sympathy in music, or sympathetic tremors. These occur when a ~~number of~~ ^{single cord only is struck &} cords emits a tone which is immediately communicated to by means of a solid body or the air ^{to} and a number of cords which are in unison with it, and which all emit ⁱⁿ at the same time, the same number of

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Vibrations. — in order to produce

It is not necessary, ~~that~~ this Unison of Vibration, ~~the is to say~~ that the impulse should be made on the same ~~instantaneous~~ kind of instruments. not only different instruments of Music, but different solid bodies ~~can~~ ^{can} vibrate together when they are in Unison with each other. Thus for Eg a musical cord vibrates with a human voice — a glass filled with water, & rubbed with a finger, ^{vibrates} ~~the~~ a flute — a pipe & glass, with a trumpet, — and the Bag-pipe, ^{vibrates} with a stroke upon a kettle drum. The same occurs to all solid bodies whose particles are calculated or formed to emit the same number of vibrations in the same time. —

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Besides the cords which are in Unison with each other, those cords are observed to tremble ^{up} together ~~which~~ ^{which} which are distant from each other by an octave or a fifth, than those which are distant a third, or by any of the other tones. [When they are distant from each other by an octave, and the shortest of ~~these~~ them is struck - that which is twice as long] From all these facts we learn why we feel certain vibrations ⁱⁿ ~~from~~ our bodies ^{excited} emitted by certain sounds. It is because they are more or ^{less} in Unison with those sounds. The ^{spinal} tremors of the bones of the ear & of the teeth from the ^{filing of iron} ~~noise of a filing iron~~ ^{are produced by} the ~~same~~ acute sounds emitted by the iron ^{exciting} ^{equal} ^{vibrations} in those

But
✓ When the ~~iron~~ iron which is filed is ^{can}
shorter than the membrane of the ~~ear~~
(^{ch} is about the size of a man's nail)
It emits more acute vibrations than
can be returned by the membrane of
the ~~ear~~ ear, & hence it is sometimes
captured by that ungrateful friend. In
like manner

[There you see that even in ^{dead} matter
there is a certain relation established
between Stimulus & motion. It extends
to the ~~moral as well as to the animate~~
& inanimate ~~world~~ ^{as well as to the inanimate}
animated world. Nay - more - it extends
to ^{all the operations} ~~moral~~ of the human mind whe-
-ther they ^{be} ~~are~~ excited to moral - intelle-
-tual - or political Subjects. —

parts of the body. ⁴¹³ It is remarkable that
the size of the parts acted upon in &
out of the body, and their ^{matter} quality are
nearly alike. Their tremors are thereby
nearly equal. ^V Windows - doors & even
houses sometimes tremble in like manner.

~~and~~ under the impression of correspon-
ding Vibrations. — The fall of the walls of Jericho
recorded in the old testament has been ascribed to the voice:
a tone from a grave to an acute one
producing vibrations produced by the blowing of a horn. ~~It~~
from a human voice has by this
means sometimes broken a glass cup.

That sound should be produced, tre-
mors should be excited not only in the
air, but in the body which emits it.

For an acc^t of the manner in w^{ch}

the air is acted upon in producing
I refer you to writers on great Philosophy.
Sound see Dr Hales on forces § 22.
^{I said formerly}

① The presence of air is necessary

V But In order that dense air should
convey sounds, it should possess at the
same time elasticity. It is upon the
account of the peculiar elasticity of the
air in warm climates that sounds
are more intense than in cold countries,
~~are transmitted more extensively~~
Notwithstanding the air in the latter is
more dense than in the former. It
is owing to the greater density of the earth
near the surface of the earth that the noise
of artillery is sometimes heard 40 leagues,
while thunder is heard in the opposite
sides of the air but two leagues.
A public speaker for the same reason is heard
more distinctly ~~up~~ near the level of his
breath ~~up~~ near ^{the} floor of a house, or the

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to the production of sound. a bell struck
with a hammer in an exhausted receiver
= ver sends forth no sound. - The ~~tenacity~~
The degree of ~~tenacity~~ intensity in sound
of air ~~likewise~~ ~~as a sound is nearly~~
is greatly influenced by the tenacity
density of the air. A pistol discharged
= ged at the top of the pile of Teneriff can
scarcely ^{be} heard by the person who fires
it. ^r Sounds are heard less easily in
cloudy & rainy, than in clear weather.
Sound is supposed to travel 1142 feet in
a second. This has enabled philosophers
to ~~dis~~ tell the exact distance of
thunder by counting the seconds between
the flash of the lightning, & the report
of the thunder. Against a contrary
wind sound travels according to D^r Haller
with $\frac{1}{22}$ less velocity than in a quiet

than when elevated above them.

✓ This is so remarkable that the famous blind philosopher Desnoyes could tell the moment he trod upon the floor of a room, or heard a person speak in it whether it was furnished or not.

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convey it to a greater distance, ^{and} ~~than the~~
~~air~~ ~~the~~ with an accumulation of
sound. The ticking of a watch, & even
the scratching of a pen, is heard with
much greater force at the extremity
of a long mast than where the sound
is first emitted. The increase of sound
is occasioned by the tunors excited,
being all in unison w: ^{the} ^{eg a violin.} each other.
The sound like light is reflected from the
bodies on which it strikes in an angle
equal to that its incidence. ~~the~~ In
passing thro' ^{Spiral} ~~bodies~~ bodies its force is en-
creased by every reflection as we see in
the ~~speaking trumpet~~ ^{the tongue} ~~of a~~ ^{the} ~~conch shell~~.
In the ~~farther~~ ^{collected} ~~there is~~ speaking tun-
= but the sound is ^{collected} preserved & increased by

v between air - water - ⁴ and light, and the
tumors of sound - The force of each is
increased by being confined. -

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consonant tremors - but in the
longue shell - there ^{are} not only conso-
nant tremors, but a number of
reflections, which add greatly to the
sound. These reflected sounds travel w.
so much velocity, that they frequently
cannot be distinguished from the primary
sound. It is agreeable to observe the analogy
~~of~~ ^{of} ~~the~~ ^{the} ~~analogy~~

When sound travels 63 or 64 feet
and strikes against a body united to it:
- flut its vibrations in an an angle
equal to its incidence, such as a ^{great} ~~solid~~
hill, or a rock - ~~and when~~ these vibrations
are returned to the ear, ^{& no} ~~no~~ difference
will be perceived between the primary
sound & its reflexion which has been
called Echo. At 63 or 64 feet, the

✓ different state of the atmosphere has
influence upon the number of Syllables
returned to the ear by an
thus we are told 20 Syllables
during the night at a place
called Woodstock in Oxfordshire, and but 17

During the Day.

I am about to deliver upon this subject
The lecture, I fear will be tedious & un-
interesting compared with the Demon-
strations of the Organs of the ear by
the Professor of Anatomy, but a short
Description of them is necessary in order
to enable you ~~to see~~ to
understand the manner in which
hearing is performed, and several of the
phenomena connected with it. //

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Speech consists of one syllable - at ~~170~~
of two - and at 190 of three syllables.
& at a greater distance of words, or a
larger collection of syllables. Thi^V

Lect: 16

• We come now agreeably to the Order
proposed, to speak of the Structure of
the ear, & of the manner in which
hearing is performed. [this part of our]

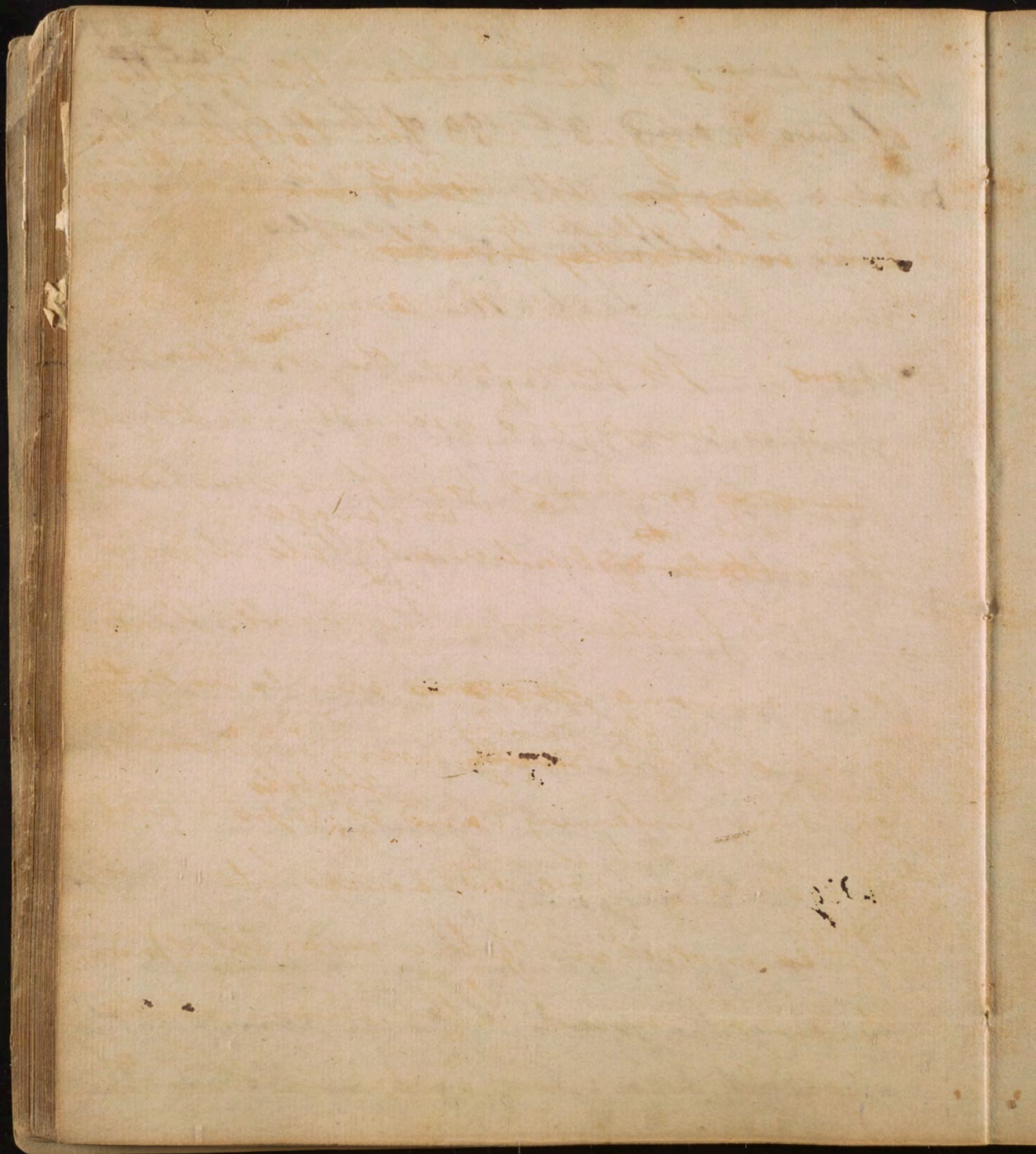
The organ of hearing is divided into
three parts. viz: the external ear -
& meatus Auditorius.

2 The Cavity of the Tympanum.

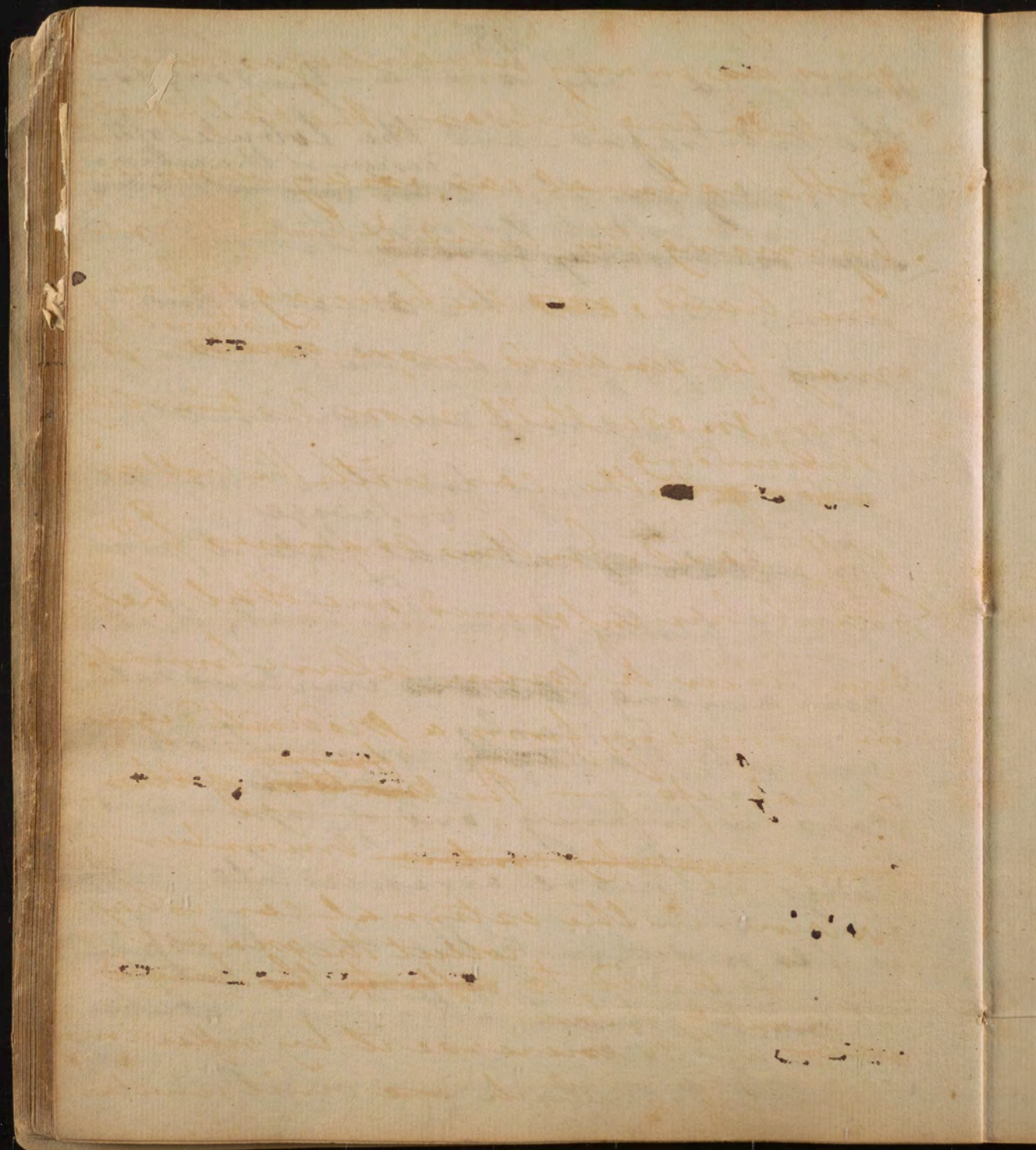
3 The Eustachian tube.

long

I need not detain you ~~on~~ in
naming the parts which compose the
external ear. They are the Helix - the



Antitragus - The Cornua - the Tragus -
 the Antitragus - and the Lobule of the
 ear. ~~The~~ ^{Design of the external} ~~the~~ ~~Antitragus~~
 ear is to collect the rays of sound and
~~and convey them into the~~ convey them into the Meatus Auditi-
 -vus. - Its form, and the matter of
 wh it is composed, are admirably
~~for~~ contrived for this purpose.
 In ~~the~~ ^{the its} ~~its~~ ^{or usage} natural state, it projects
 much further from the head, than it
 does among ~~the~~ civilized nations,
 owing to the ^{early} ~~early~~ compression of
 caps in infancy, and of ^{wiglets} caps - and
 Wigs in more advanced life. - It
 is ^{from} ~~this~~ projection of the ear, that Indians
 hear so much better than ^{civilized} ~~the~~
 people - a circumstance this w^{ch}.



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gives ~~so~~ ^{them} many advantages over us
in hunting & war. The flat figure
of the external ear, may be secured
by raising the helix & antihelix.
One hand, ~~and~~ the hearing thereby
may be rendered more ^{distinct} ~~clear~~. It
may ^{be} made still more distinct by
~~surrounding~~ ^{surrounding} the ear with the hollow
of the hand. In this manner Dr.
Franklin informed me that he
once knew a man relieve himself
in company from a moderate degree
of deafness. — The ~~best~~ ^{best} of the
~~voice is happily united~~ number of
divisions in the external ear is hap-
pily contrived to ^{collect the greatest} ~~collect the greatest~~
~~quantity of sound~~ and to increase it by reflections
from bodies which are in it similar

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420
vibrations. The ^{empty} ~~soft~~ ^{labyrinthine} ~~substance~~
& cellular substance of the ~~external~~ ear,
while it is competent to these
vibrations, is nevertheless so soft as
to prevent creep in these vibrations.
That the ^{external} ear serves the important pur-
pose of collecting - reflecting - and con-
-verging the ~~rays~~ rays of sound, we infer
from the diminution of the ^{power} of
hearing by ~~the~~ ^{its} ~~loss~~ ^{of the external ear}.
- In many animals the external ear
is moved with great celerity by a number
of muscles fitted for that purpose. But
the facility & velocity with which the
ear is moved in the direction of
sound by means of the muscles ^{which}
move the head in the human species,

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renders such a motion in our ears unnecessary. There ^{have been} ~~are~~ instances however of men who ^{have} possessed a power of moving the ear by means of ~~the~~ ^{the} muscles which ^{are} ~~are~~ attached to it. — ~~It is said the~~ celebrated Albucasis possessed this power, & ^{used to} ~~mentioned~~ in his lectures an example of the same kind in a student of medicine who formerly attended the lectures in Paris ~~at Paris~~

The meatus Auditorius begins at the Tragus & Concha. It is ^{wholly} ~~partly~~ cartilaginous in infants, but becomes ^{partly} bony & partly cartilaginous in adults. It is wider at ~~its~~ its two extremities, than in its middle. over its whole surface is spread a thin sensible

membrane, covered with epidermis,
 and affixed to ~~the~~ the lower ^{part} ~~part~~
 of the meat: And: by means of bil:
 -lular membrane. In this cellu:
 -lar membrane are numerous little
 glands which secrete a yellow wax
~~which is of a bitter taste~~ which by its
 viscosity & bitter taste is ~~said~~ said
 to be intended to defend the internal
 part of the ear from insects and

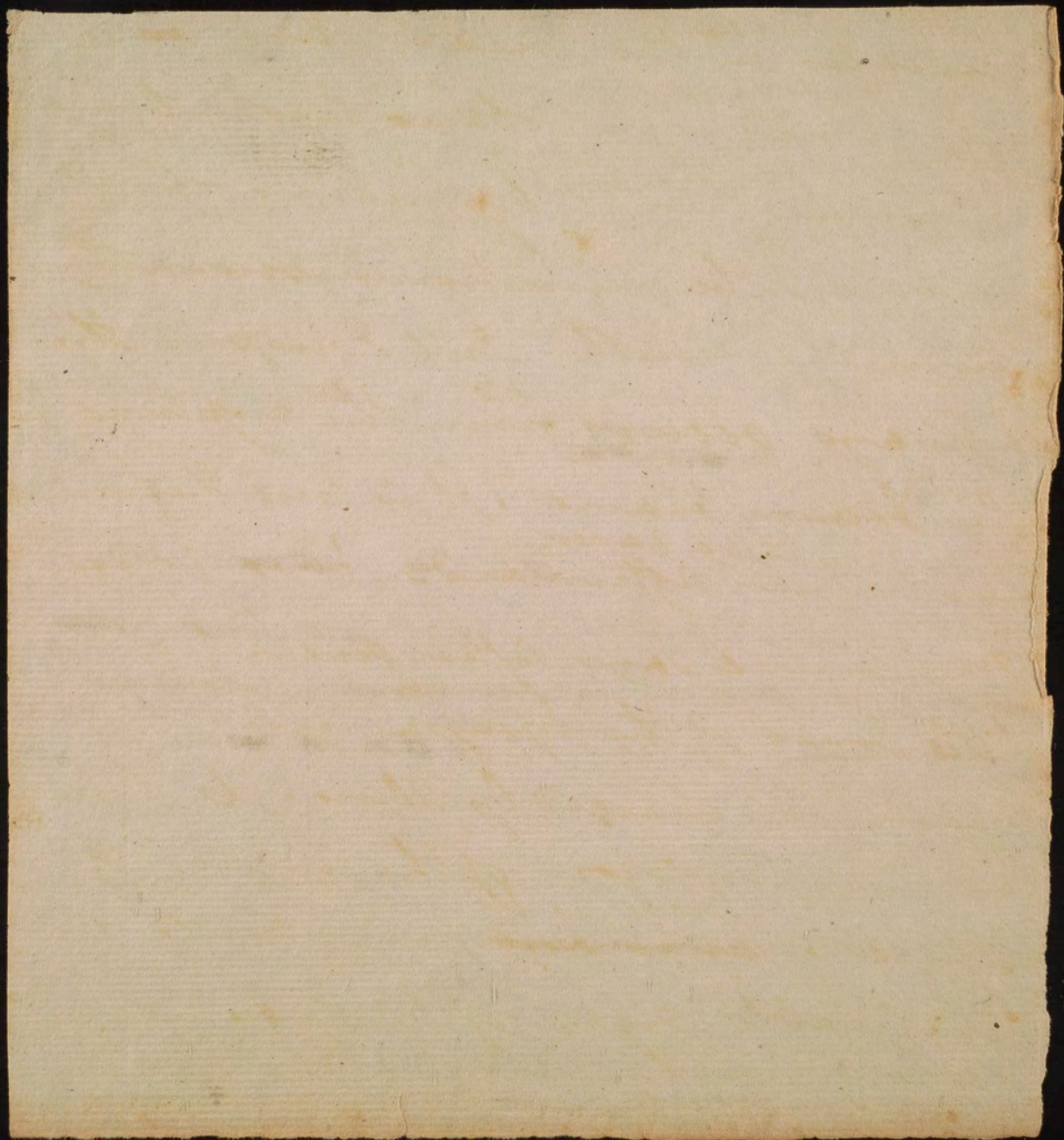
^{this} In a groove of albugo
~~ring~~ ring at the extremity
 of the meat: And: And connected
 with the os petrosum ^{or the stony bone,} so called from
 its ^{being 100 times more so than} early & peculiar hardness ^{any other bone} is placed
 a ^{in the body} membrane in an oblique direction
~~being by its position to the ear,~~

5.
✓ This membrane is said to contain
a small opening in it which ~~communicates~~
=nicates ^{to} the meat. And: ~~but~~ This
is inferred from tobacco smoke being
thrown thro' it by means of a
papage to be mentioned presently
from the mouth. But I suspect this
always occurs from the rupture of
this ~~membrane~~ ^{membrane}. It is true the hearing
continues ^{in these cases} afterwards, & so it does
Dr Monroe says after several of the
little bones of the tympanum are
eroded, & discharged by Ulcers. It shows
the kind provision of the Author of
Nature to ~~defend~~ ^{preserve} ~~the~~ perpetuate the
invaluable Organ of hearing. —

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called Membrana Tympani. It is
nearly horizontal with the ear
because the greatest number of sounds
that affect ^{us} come from below it. †

It is of an oval shape - convex below
the middle towards the Concave of
the Tympanum, & Concave towards
the meat. aud., & convex above the
middle, & concave towards the hollow
of the Tympanum. It is said to consist
of six lamellae or plates, for aneur.
of which see Anatomical Writers.
It is however very thin. Its fabric-
situation - & exquisite possibility
qualify it in a peculiar manner
to receive & convey sounds into the
internal ear. ✓

† The same accommodation not only of the inner, but outward structure of the ear, to the direction of sounds, is observed in many animals besides man. In the Owl which looks down from the limb of a tree for its prey, the ear projects more above, than below - for the ~~foot~~ which looks up to the ~~chimney~~ ^{chimney} for its prey - the greatest projection of the ear is downwards. In the pole cat it projects ~~before it~~ ^{to receive sounds} before it and in the hare ~~the~~ ^{the} ~~ear of~~ ^{ears are always} ~~directed backwards~~ - the ear is ^{lightest} ~~directed backwards~~ ^{to} receive the impression of sounds from behind it - a quarter from which its danger & death are chiefly derived. But to return. The membrana Tympani in the human species is ~~see~~



✓ The fenestra ovalis is ~~fenestra~~ ^{said to be}
convey distinct sounds to the sensorium,
while indistinct sounds are conveyed
only by the fenestra rotunda. The organ
of hearing from this you see is twofold.
One part serving to convey simple sounds,
& the other to distinguish them, or if I
may be allowed the expressions to secret words
~~from~~ from them.

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This 2nd part w^{ch} ~~is~~ named, consists
of the Cavity of the Tympanum, so
called from its resemblance to a drum.
It lies in the Os petrosum. It is
irregularly round, and its length is
greater than its depth. ~~It~~ It is sur-
rounded before, by the membrana tym-
pani and behind, by a bony septum
of the Os petrosum which separates
it from the 3rd or innermost cavity of the
ear. The Septum is perforated with
two holes which are named from
their figure fenestra ovalis & fenestra
rotunda. ~~Between~~ the bony space
of between these two windows is called
promontorium. It divides the Tym-
panum into two parts. ✓

In the superior & anterior ~~part~~^{beginning} of the
 Tympanum, we find the ~~entrance~~
 of the Eustachian tube which after
 perforating the ~~external~~ os petrosum
 process, ~~being~~ gradually enlarging,
 till it ends in a small pouch behind
 the ^{soft} palate near the external ^{wing} of
 the Pterygoid process by an oblique ~~process~~
 orifice. This is this orifice, the pituitary
 membrane of the nose which ~~the~~
 lines the internal surface of the tube,
 enters the tympanum. ~~It is~~ This
 tube is always open. Hence the air
 passes freely into the tympanum, &
 humors distill easily from the tympan-
 um into the ~~mouth~~^{mouth}. — The presence of
 air in the Tympanum is ~~always~~

2 ~~For the purpose of the former~~ It
is necessary further that it be admitted
frequently ~~as~~ ^{as well as} ~~as~~
constantly thro' the Eustachian tube,

Otherwise it would soon become of
a different quality as to moisture &
Dryness - Density & rarity from the
Air which converges ^{the} sounds into the
external ear; the consequence of which would
be, we should not be able to hear
sounds as they occur in the external
Air. ~~hence, where~~ ~~the entrance of~~

^{is obstructed} this tube by a Cold ~~the~~ the entrance
of fresh Air prevented every day, the
sense of hearing is ^{impaired or} ~~lost~~ ~~alters~~,
- The entrance of this tube is guarded

by several small muscles which con-
tract it in the act of Swallowing. When

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~~be~~ necessary to perfect hearing. ✓

Within the Tympanum are four little bones, the names of which are taken from their figure. They are called Mal-

-leus - Incus - Os orbiculare & Stapes. They are enveloped in moisture which serves to render their motions easy.

~~are~~ in the tympanum. It is supposed ^{use of the} by ~~Chalcidius~~ that the Stapes as is to

open on ~~close~~ ~~the~~ fenestra Ovalis

according to $\frac{1}{2}$ greater or less acuteness of sound. ~~all~~ ^{all} the above four bones are connected ^{to} each other.

The last part to be mentioned belonging to the Tympanum is Chorda Tympani. ^{is a nerve which} It descends thro the middle of the internal surface of the Membrana Tympani. It arises from the Dura

These muscles are destroyed as sometimes
happens in the Venereal disease, the
Aliment is swallowed with pain &
noise. In ~~these~~ instances have been
known of its being forced thro' the
tube into the tympanum & thro'
the ruptured membrane to ^e exte-
=nal ear. — The Eustachian tube
is said to ~~not~~ afford a passage for sound
when the mouth is open - but this is
not the case, as may ~~be~~ easily be proved
by putting a watch in the mouth in such
a manner as not to touch ^e teeth. No
Sound or ticking of the watch will be heard.

water of the Auditory Nerve. This
 cord is supposed to be the medium
 of common sensation of the ~~ear~~^{ear}.

The whole Tympanum may be consi-
 dered ^{as} the Antichamber of the
 peculiar ~~Organ of hearing~~^{Organ of hearing}.

It is admirably
 formed for this purpose. The Mem-
 brane of the Tympanum is ^{it increases}
 sound by its drum like form.

The Tympanum regulates the Quan-
 tity & force of the rays of ~~sound~~^{sound}.

The Air & bones in the Tympanum
 convey it to the ~~two~~^{two} windows

thru which it is conveyed into the
 112nd part I mentioned called from
 its numerous windings the Labyrinth.

It consists of three parts viz. Vestibu-
 -lum - three semicircular canals,

Of the cochlea. —

The vestibulum is a round cavity in the os petrosum behind the ~~foramen~~^{fenestra} ~~tranversarium~~^{tranversaria}. It is lined with a ~~for~~ soft nervous membrane, ~~which~~ but in such a manner that a fine vapor is insinuated between ~~the~~ it & the bone. It communicates ^{to} the tympanum by means of the fenestra Ovalis, ~~the~~ There are besides five orifices from the 3 semicircular canals, & several openings for ~~the~~ blood vessels & nerves ^{which} open into it. The cavity of the Vestibulum is filled with water ~~and~~ by a canal which arises from a transverse process of the Dura Mater. It is called Aqua: Ductus Vestibuli.

[Faint, illegible handwriting in cursive script, likely a letter or manuscript page.]

The three semicircular Canals lie
 posteriorly and superiorly in γ of
 petrosum. They are lined with periotum
 & filled with a nervous pulp, between
 both of which a moisture is interposed.

The Cochlea ~~is situated~~ is situated ante-
 -riorly in the α petrosum, before the
 semicircular Canals, but in such a
 manner that its base is turned backwards,
 but its apex forwards & outwards. It
 is formed of two hollow windings like
 a snail's shell. ~~It is divided into its~~
~~two parts by a canal~~ extends thro
 its whole length, & is perforated
 in its base with numerous holes.
 It is ^{long & captilaginous} divided by a Septum (called Lamina
Spiralis) ~~into~~ into two semicanals,

part
The ~~bone~~ ^{bone structure} of the
= upary, that the cords which are attached
to it might resound - for musical cords
~~are fastened~~ when fastened to soft
bodies emit no tones. -

or winding stairs. 430
called Scala, The internal portion
Scala terminates in the fenestra rotunda
& is called Scala tympani. The anterior
opens into the vestibulum. It is called
Scala Vestibuli. ✓

The Cochlea is constantly ^{filled with} ~~filled~~
by means of a canal ^{water} ~~water~~ conveyed to it from ^{the} ~~the~~ cavity
of the skull. ~~by a canal~~ It
perforates the os petrosum, & ends in ^{the} ~~the~~
Scala of tympani, near the fenestra
ovalis. It is called Aqua ductus cochleae.

Thro' every part of the Cochlea are
distributed nervous fibres from ^{the} ~~the~~
pair of Nerves. Those parts of ~~these~~
Nerves which go to the Cochlea are
called Portio mollis.

~~The other parts of the ear,~~

✓ It is ~~the~~ here that Speech is formed
as it were out of Sound, — and it was
by an imitation of one part of the
Labyrinth viz the Cochlea, that Dyo-
nissus the tyrant formed his prison
tho' whose spiral windings he distinct-
ly heard the smallest whisper that
came from ~~the~~ his prisoners.

~~and for the purpose~~

The ~~sense~~ sense of hearing is said by
 MeL at to be seated in this ~~the~~ third
 division of the organ of hearing, consist-
 ing of the vestibulum - $\frac{1}{4}$ 3 semicir-
 cular canals - & the Cochlea. ~~For~~ They
 are to the other parts of $\frac{1}{4}$ ear what
 the retina is to the coats & humors
 of $\frac{1}{4}$ eye. V

From this minute ~~the~~ ~~of the~~ ~~of the~~
 Acc² of the structure of the ear, you see
 that it is formed upon ^{the} principles w^{ch}
 were laid down formerly, ~~to~~ in
 such a manner as to collect - to
~~to increase~~ - ~~the~~ on
 preserve - to convey - ~~the~~ ~~the~~
~~the~~ to moderate sounds so

✓ The Vibrations which produce these
Sensations are all subject to the laws
of musical sounds. ~~Formerly mentioned.~~

— E.g. tones are conveyed only by means
of cords, or bodies ^{which} emit vibrations
that are related to each other ^{what are called} by ~~the~~ ^{consonance} ~~by~~ ^{Octaves}
— 5^{ths} or 3^{ds} — so that hearing

may be defined to be an harmonical
vibration or trembling of the ear. The

membrana tympani is extremely use-

ful for this purpose. By means of the ^{muscles of}

the malleus ~~it~~ it is relaxed or stretched so

as to accord with ^{a number of} ~~an~~ ~~sorts of~~ variety

of sounds
so great as almost to elude calculation.

There are some sounds so great or so small

as not to be perceived by us. The reason is,
they cannot find a consonant cord in

the spiral lamina of the cochlea. ~~From~~

Hopkinson's case — ^{may be} ~~cannot~~ ^{heard} ~~not~~ ^{heard} ~~not~~

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as produce the sensation of hearing
in the mind. V

The progress of Sound is indeed circuitous
and the number and combinations of $\frac{c}{y}$
component parts of the ear not only
oppress the memory, but overwhelm
the imagination. But they ~~use~~ use
^{without} all of them the Ear could
all useful. - ~~the voice of human life~~
not have been a perfect musical instrument,
~~or have vibrated nearly all possible sounds.~~
In children the hearing is ~~is~~

~~is~~ dull for some months from a
quantity of mucus which lines the
membrana tympani. This is kindly
intended to prevent their tender organs
from being injured by too forcible
sounds. It is remarkable that the
bones ^{and other parts} of the ear are as large in

Story of Roxas & the bells.

from p 53 of Mrs. Place book

again, a gentleman from Mexico who attended the lecture ~~in 1810~~ ^{in 1810} ~~a~~ ^{being} ~~last~~ ^{with several other boys the steeple of} ~~the~~ ^{went when a boy into a Church in that} city, at a time when twelve large bells were ringing in it. The wife of the man who had the charge of the bells lived in a room ^{which} adjoined them which communicated with the belfry by means of a small window. While the bells were ringing the boys ~~the~~ ^{playful} became noisy, in upon which ~~the woman~~ ^{the woman} in the adjoining room went to the window, and commanded the boys to be silent, or to depart from the belfry, for that they made such a noise she could not hear what that was said in her family. There are see the spiral laminae of the ~~lungs~~ ^{lungs} vibrated with noise, but not bells.

remains only, & in speaking of the structure
of the ear, ~~it would be impossible to~~
take notice of the distribution of a
part of one of the Auditory nerves to the
eyes - the organs of Speech & the heart,
and of the wise purpose for which it is
intended. It serves to ~~promote a quick~~
~~the words~~

Consent & cooperation between ~~the~~
~~parts~~ hearing, speaking & feeling. It is
particularly useful to ~~the~~ protect us
from sudden & unexpected ~~evil~~ evil which
approaches us in the form of sound, ~~by~~
~~heart to feel, & the~~ ^{by} ~~the~~ ^{open}
~~disproving the~~ ^{voice} to proclaim ~~the~~ danger,
& thus to dispel that evil, or to obtain
the help of our friends.]

V The ear is of more importance to us than
the eye as spiritual beings, ^{inasmuch as we require} most religious
ideas thro' ^{the} ear. The words beget ideas in writing
- visible - not audible ideas guide the
hand & heartily.

Children at five months old as in
Adults. ~~IV~~

We acquire our knowledge of the
~~directions of sounds~~ only by experience.
Thence we observe children when
spoken to for a while, turn their
heads in every possible wrong ^{dire-}
ction, before they hit upon that w:
is most favourable for the reception
of sound. — We learn the nature of
sounds likewise only by experience. Of
this Dr Reid informs us of a striking
proof. He tells us that he was once
suddenly terrified as he lay in his
bed, and heard a violent ~~thumping~~ ^{thumping} ~~noise~~ ^{noise} ~~more than once~~ ^{more than once} ~~from~~ ^{from}
led him to rise ~~several times~~ ^{his}

✓ The descriptions of Ventriologists are
founded upon ~~the~~ ^{this. correct & exquisite} ~~the~~ ~~delicacy~~ of ear whereby they acquire
a knowledge of the specific sound which a
voice produces in all the different directions
it can assume in a room. The voice of the
ventriologist is always an artificial one,
& hence it is not recognized, nor associated
with his person. ~~and~~ He is not in this
case only, that new sounds in which there
is the want of experience to ~~be~~ inform no
of their direction, derive the ear. The ~~voice~~ ^{uncommon} ~~voice~~
voice of an earthquake is generally derived
from two or three different, and sometimes
opposite quarters. The same thing takes
place ~~at the~~ ^{the voice of} the first time certain birds &
beasts are heard in the woods.

~~Heard of him & saw the old man~~
~~in bed~~ — bed, and to open
 his door to see if any body knocked,
 nor did he discover for some time
 that the noise he heard was occasioned
 by the ~~noise~~ violent palpitation
 of his heart brought on by fear.
 The D.^r had never ~~heard~~^{heard} that sensation
 before. — V

Hearing is not an independent
 sense. It owes something to the nose.
 Hence we hear ~~better~~^{better} after sneezing,
 for by this convulsive motion, the
 Eustachian tube is cleared of
 stagnated fluid and ^a more easy passage
 is made in it for the entrance of

✓ It is remarkable, that hearing is
~~more~~ ~~more~~ imperfect, when one ear is only
moderately impaired in its capacity of hearing,
than when it is ~~so~~ incapable of hearing any
thing. The imperfection of the unsound ear
confuses the sound one.

fresh air (corresponding with the external air) into the Tympanum.

2^o It is indebted to the eyes. Hence we hear best when we look steadily at the person ^{who} ~~speaks~~ speaks to us, but if ~~the~~ the sense of hearing ~~be~~ is impaired, ^{from the eyes} ~~without~~ this aid is necessarily sacrificed to the greater advantage of ^{filling} ~~the~~ the whole of the ~~the~~ external ear with the rays of sound; and hence we observe that deaf persons always ^{turn their side face on} turn one of their ears, ~~and~~ towards the person who speaks to them!

3^o The sense of hearing is indebted to the mouth. Hence we hear best with

V tube. ~~It~~ ^{hearing} is probable ~~that~~ may
~~be~~ be increased by both these
causes, but I am disposed to ascribe
it chiefly to the ^{meatus auditorius,} ~~passage of air~~ or
that ^{which admits} passage of air into the ear, being
widened by the ~~depression~~ depression of
the two condyles of the lower jaw.

the mouth open. ~~Both~~ ~~the~~ poets
& painters have borne testimony to the
truth of this observation. Shakespear
describes his Blacksmith ^{receiving} ~~contending~~
his "Troylois" ^{mouth} ~~mouth~~ with a gaping
& Leonardi paints a country congregation
listening to their parish minister with
the same position of the lower jaw.

The hearing is more acute in this
case when the breath ^{is} suspended.
- When the mouth is open, - more
sonorous rays are conveyed ~~to~~ ^{this has been ascribed} to the
ear than when it is shut, ~~probably~~
~~to~~ ^{to} the continuation of substance, ^{to} ~~the~~
particularly the teeth,
and (when we cease to breathe) the
air ^{entering} ~~entering~~ more easily this ^{to} ~~of~~ [✓] ~~instinct~~.

V I have before mentioned the translation
touch, taste and smelling. The sense of hearing
of the sense of ~~vision~~ ~~the sense of sight~~
in like manner has sometimes been translated. It
was so in Han Boeshaave nephew to the
illustrations Physician of that name. ~~It~~
~~is translated~~ ^{fishy} ~~seem to~~ hear in the same man-
ner. Some deaf persons are able to dis-
tinguish difference of sounds without
being able to understand the difference of words.
Dr Haller mentions as a proof of this, the
case of a man who could always distinguish
the sound of a Drum from all other sounds
by its producing a pain in his belly. The
following curious paper shows that all the
senses may be translated in the same
paper person. I wish it to be attended to, for
it opens a wide field for explaining many ~~other~~
~~phenomena~~ phenomena in the history of diseases.

Extraordinary Woman.—The Paris papers
recount prodigies of a woman in the neigh-
bourhood of Lyons. The circumstances of
her case have confounded the philosophers,

506 1625

~~Table~~
~~the purpose of~~
~~by~~ — That the teeth and
 bones of the jaw & head convey sound
 from the mouth has been proved by
 many experiments. ~~Even~~ ^{even} ~~deaf~~
 means of speech have been conveyed
 by these means thro' the ear to the
 mind. This method of imparting
 knowledge was ^{discovered} ~~discovered~~ in
 Germany by a young lady who was
 deaf, catching ^a ~~the~~ tone ~~of~~ ~~her~~ ~~voice~~
 by listening with her teeth accidentally
 upon her sister's harpsicord while she
 was playing. — It is remarkable
 that many deaf people hear perfectly
 well in riding in a carriage over

Extraordinary Woman.—The Paris papers recount prodigies of a woman in the neighbourhood of Lyons. The circumstances of her case have confounded the philosophers,

500 1825
and left her no credit with men unaccustomed to scientific reasoning. Learning hesitates, because it wants principles to explain;—Ignorance decides at once, because it knows not the variety of undiscovered principles which exist.

The case of this woman is, that of a confusion of all senses—of seeing, smelling, hearing, touching, tasting. The quality of one sense seems transferred to another; there is a kind of organic confusion and substitution; the eyes do duty for the ears, the taste for the eyes, and the touch for the taste.

A very learned physician, a writer in the *Journal de Saure*, gives an account of having visited this woman at Lyons:

“To believe in apparent impossibilities (he says) is often the necessity of men of science; but it is their good fortune likewise to discover that the world contains many more miracles than is first imagined, and that nothing is impossible, as referred to the Omnipotence of the DEITY, and that impossibilities are much rarer in the combinations of human life than the vanity of science will acknowledge.

“This woman, whom I visited, and to whom I presented several sorts of medicines, powders, simple compounds, and many other substances, which I am convinced she never saw before, told me their several tastes, as nearly, and with as much precision, as taste could pronounce. She described them, indeed, with astonishing exactness, and frequently when my own palate was confounded.

“Her eyes were next bound with a thick bandage, and I drew from my pocket several sorts of silk ribbands. All these that differed in the original colours she immediately told me. It was in vain to attempt puzzling her; she made no mistake; she passed the ribband merely through her hand, and immediately decided on its peculiar colour. She could, in fact, discover the quality of any thing by the touch or taste, as accurately as I could with my eyes.

“The organs of hearing were then closed as well as the contrivance of stuffing the ears would answer the purpose. I then commenced a conversation with a friend in the apartment, and spoke in an almost inaudible whisper. She repeated, with great power of memory, every word of the conversation. In short, I came away a convert; in other words, I believed what I had seen. A Philosopher knows the fallibility of the senses; but he should know likewise that science ought not to reject because it cannot have demonstration. We must admit miracles, and the power of miracles, or we must question almost all the appearances of nature. Ignorance doubts what it chooses, it may easily understand; science endeavours to comprehend, and, when it cannot, it submits to the senses.”

TAKE NOTICE.

THE Creditors of SHANNON & POALK are reminded, that the term allowed for them to accept the assignment of said Shannon and Poalk, and grant a discharge, will expire on the first of March ensuing, after which period, they will be debarred the benefit of the property assigned; and those who wish to take the benefit of the assignment, will please call on

John Fries,

Corner of Market and Third-streets, or

William Shannon,

No. 183 Market, near Fifth-street.

feb. 24

dtM1

REMOVAL.

The subscriber informs his Customers and the Public, that he has removed his Grocery Store, and

COFFEE MANUFACTORY

From No. 453 north Second-street to No. 198 south Fourth-street;

WHERE he means to carry on the Business of preparing COFFEE, as usual; the quality of which may be relied upon to exceed any that has been offered for sale in this city. To prevent imposition, his name, place of residence, and price, will be marked on every package.

Henry Barrington.

Orders from the City or Country will be punctually attended to by applying as above; or to Mr. Joshua Saltonstall, at the corner of Second and Coates's-street; Mr. Charles Barrington, No. 216, Market-street, or Mr. Richard Barrington, at the corner of Almond and Front-streets, Southwark.

TO LET, a large room which has been occupied as a Billiard Room and would make a very convenient School room; apply as above.

dec. 11

wstf

FOR SALE,

ALL THOSE FOUR HANDSOME

Three Story Brick Houses,

SITUATE on the south side of Chesnut street, between Seventh and Eighth streets, as here-

No. 174, containing in front 23 feet (or thereabouts) by 44 feet deep; the lot extends to the depth of 145 feet to a nineteen feet alley, on which is erected a brick Coach House and Stable.

No. 182, containing in front 23 feet by 44 feet deep, with an octagon in the rear which extends 6 feet farther; the lot is 145 feet deep to the aforesaid alley.

No. 184, containing 23 feet front by 44 feet deep, with an octagon in the rear, similar to the house above; the lot extends 145 feet to the alley.

No. 186, containing 23 feet front by 44 feet deep; the lot extends to the alley aforesaid.

Also, a vacant lot of ground on the south east corner of Chesnut and Eighth streets, containing in front on Chesnut street 22 feet, and in depth 100 feet.

Also, one other Lot adjoining the above, containing 22 feet 4 inches front by 100 feet deep.

For particulars please to enquire of the subscribers.

William Ashbridge,

Samuel Williams, junr.

John Richards,

Assignees of William Hamilton.

dec 28

tuthstf

FOR SALE,

A PLANTATION

The Persons who have been long exposed
to a great noise, the Membrana ~~of the~~
Tympani becomes ~~very~~ ^{relaxed}, that it
cannot stretch itself into a sufficient
degree of tension to receive small tones.
This is the case in a more especial man-
ner with millers. - Hence among the
vulgar when you speak to them ⁱⁿ too
loud a voice - they tell you - "that
they were not born in a mill." - The
inhabitants of the neighbourhood ^{the falls of} of
the Nile are unable to hear when they
remove beyond $\frac{1}{2}$ reach of its noise.
There is a Gentleman in Carolina

438
stones on
rough roads. ~~Effects~~ This was the
case his Mr Hawkins tells ~~us~~ us with
Dr Johnson, ~~Dr Johnson~~ & he adds fur-
ther upon the authority of a Dr Pope
the history of a lady who ~~could hear~~
only while a drum, was beaten ~~before~~
~~her~~ ~~these sounds appear to act~~
~~only by giving more tension to~~
the membranes of the ear ~~so to~~
enable it to receive sounds which
would otherwise be lost upon it.

intimate
There is a connection between the
ear and the human voice, ~~by the~~ ^{by the organs of} the human voice, ~~the~~ ^{the} ear
is the sole judge of the ~~strength~~ ^{strength} of the
sounds uttered by ourselves - hence we
observe deaf people to lose their ~~voice~~ ^{presumption}
of the strength of their own voices, & to speak
lower than usual.

Who can hear ^{distinctly} only in a room where
there is either vocal or instrumental
music.

The extent and correctness of hearing is
much increased by certain diseases - especially
• where they affect the brain. of this more
hereafter.

I said formerly that the ears are
more faithful than the eyes in retaining
+ knowledge acquired by them. ~~the same~~ ^{another}
~~reason~~ besides that of Association of
ideas may be given for it. We acquire
a knowledge of the objects of sight instantane-
ously - but not so - the knowledge of the
objects of hearing. ~~the~~ Voices & words
are acquired slowly & with difficulty in
early life, and hence they ~~are~~ take a stronger
hold of the ear & the mind, than objects of
sight take of ~~the eye~~ ^{the mind}.

I said in speaking of vision, that
from ~~some~~ ^a defect in the Organization
some people were incapable of ^{Distinguishing} ~~seeing~~
certain colors. The same thing may be
said of the sense of hearing.

=. The sense of hearing like the other
senses is subject to the disease I have
called error senses. Impressions sometimes
~~convey~~ ^{convey} false sensations to the brain,
from the same causes ~~as~~ that were
mentioned under the other senses. One
^{as patient in} ~~in~~ the hospital Nov^r 25 1809 ~~was~~
furnished a striking instance of it. He
was afflicted with vertigo & deafness, ^{but he} ~~he~~ heard
constantly the chirping of a bird.
— now this ^{was} produced by an impression from
another source acting ~~upon~~ upon the
— = nerve or nerves that were moved under
the stimulus of ~~that~~ that is, by a bird.

